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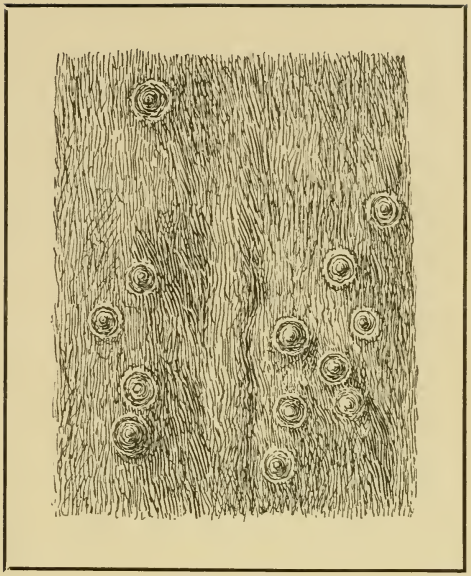

San José Scales—Magnified

THE PERNICIOUS OR SAN JOSÉ SCALE INSECT IN NEW HAMPSHIRE

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THE PERNICIOUS SCALE INSECT IN NEW HAMPSHIRE.

BY CLARENCE M. WEED.

The San José or Pernicious Scale has attracted more attention from American fruit growers during the last ten years than any other insect. It has been recognized as a most dangerous pest which was likely to be introduced into any community through the sale of young trees. It was apparently first introduced into New Hampshire at Manchester about ten years ago, but it has been repeatedly introduced since on trees brought from nurseries in other states. It is now known to be present in the following New Hampshire cities and towns, and probably is found in several others: Dover, Durham, Epping, Intervale, Manchester, Rollinsford, Seabrook.

The presence of the Pernicious Scale is difficult to detect until it becomes sufficiently abundant to injure or kill the infested tree. It then appears as a curious scaly crust on the bark. When only a few are present it is difficult to find them, as they are simply small round spots of much the same color as the bark, to be seen plainly only through a magnifying glass. Their presence generally is not discovered for two or three seasons after they first appear, by which time they have usually spread to surrounding trees.

The individual scale is a small round object closely attached to the bark, not more than one eighth of an inch in diameter and having a darker raised point near the center. At first these round scales are likely to be scattered here and there over the bark, but as they increase in numbers they are nearer together, touching or overlapping one another, and perhaps finally making a thick, scurfy layer of a grayish color that obscures the natural color of the bark, and is easily rubbed off with the fin-

ger. The presence of such a layer indicates that the sap from the bark is being sucked out by millions of the insects and that the health of the tree is being seriously impaired.

The scales that are found through the winter develop in early spring into mature insects that give birth to many young scale lice. These are tiny whitish or yellowish white creatures that crawl about over the bark for about thirty hours before they finally fasten themselves to it, inserting their curious beaks to suck the sap. They then begin to secrete the scale which is so characteristic of this family of insects. Certain definite stages have been observed in the formation of this scale. At first there is a white or fluffy stage due to the secretion of cottony threads; then a tufted stage due to waxy threads; then a black stage during which the scale becomes thicker, and finally passes into the mature form. These are the periods of the female scales. The male scales finally develop into minute two-winged creatures which are able to fly about.

FIG. 2. San José Scale: Apple Branch, with scales—natural size; enlarged scales above, at left (after Howard).

When the San José scale occurs upon older trees it is most likely to be found on the twigs and smaller limbs, but upon young trees it may occur over the whole surface. But it does not confine its attacks to the bark, for the leaves and fruit are often infested; upon the young bark and the leaves and fruit there is a very characteristic purplish ring around each scale. When the leaves are infested the insects are likely to be found along the midrib.

This pest is most likely to be introduced into new localities upon nursery stock imported from infested regions. This is believed to be the way in which it was first brought to the Eastern states. It is also likely to be carried upon apples and

pears sent to market, but this species never occurs upon oranges or lemons.

INFESTATION IN NEW HAMPSHIRE.

A few years ago there seemed some reason for hoping that this pest would not thrive so far north as New Hampshire, but this hope must be abandoned in the face of the facts now known about its presence in our state. That it can develop even as far north as our White Mountain region to an extent where it is seriously destructive is beyond further question.

The infestation first found was in the eastern part of Manchester, where a young mixed orchard of about forty trees was very severely attacked by this scale. The trees consisted of apples, peaches, pears, plums, cultivated cherries and wild cherries, with gooseberry bushes planted between. All of these, except the cultivated cherry, were very badly infested when we first visited the place one year ago. The gooseberries were so seriously attacked that they were burned, along with a large number of branches pruned from the other trees. The wild cherries were badly infested, a discouraging indication of future trouble when we think how generally these trees are distributed throughout the state. In a neighboring orchard of sixteen young apple trees two were practically dying from scale attack and others were more or less infested. Larger apple trees in the neighborhood also showed occasional scales.

The trees originally infested were sprayed in March, 1903, with undiluted kerosene, which was then believed to be one of the best remedies for this insect. The results obtained, however, were not satisfactory, only part of the insects being killed, so that by last autumn the infestation was still serious, requiring treatment this winter with a more effective insecticide.

The next region of infestation of which we learned was at Dover Point, where some peach, pear, and plum trees were very seriously attacked, and neighboring apple trees less seriously. The pest had doubtless been introduced through nursery stock, and had been developing for some years. The owner promptly sprayed these trees with the lime, sulphur, and salt wash, with the result that the nine worst infested trees were killed, though the lightly infested apple trees were not injured. I do not know just why this result should have happened.

Another infestation was found at Intervale, New Hampshire, where a row of pears along the south side of a wall were

badly infested. These were thoroughly treated with Calcothion, a trade mixture of the lime, sulphur and salt wash made by the Adler Color and Chemical Company, New York. This treatment apparently eradicated the scale without injury to the trees.

Later in the spring infestations were found in nurseries at Dover, Epping, and Seabrook, and in trees from these nur-

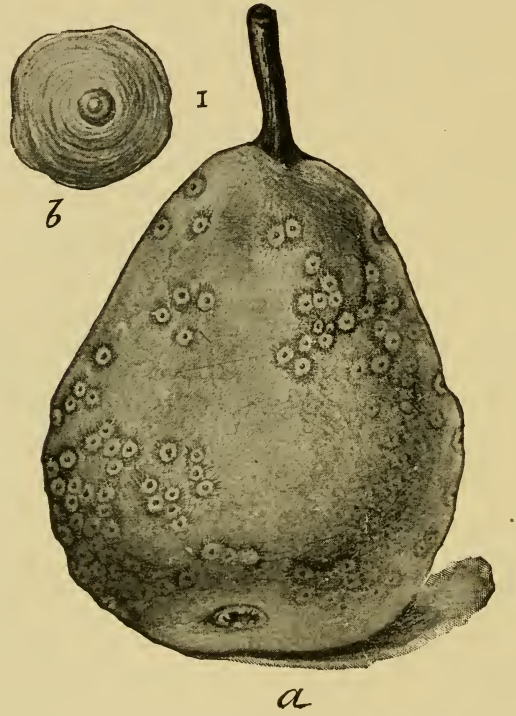

FIG. 3. San José Scale: *a*, pear, moderately infested—natural size; *b*, female scale—enlarged (after Howard).

series in Rollinsford, Lee, and Durham. The proprietors of these nurseries have shown an evident desire to prevent the spread of the pest, and have destroyed or treated the infested trees. At least one of them is planning to fumigate all his trees, which will render them safe for planting, safer in fact than ordinary trees which have been inspected but not fumigated.

Fumigation.—It is generally conceded that the fumigation with hydrocyanic acid gas of nursery trees while in their dormant winter condition is one of the most satisfactory methods of controlling the pest. Many of the largest nurseries now fumigate all their stock, and it is probable that the practice will become more general as the years go by. For this purpose a special air-tight room is set apart or built in which the young trees are placed while the deadly gas kills the insects. Any one intending to treat nursery stock in this way will find full directions in Johnson's book on Fumigation Methods, published by the Orange Judd Company, New York.

Sulphide of Potash and Lime.—An easy winter wash to apply has been tested and recommended by Prof. W. E. Britton of the Connecticut Experiment Station. It consists of:

Sulphide of Potash	10 pounds.
Lime	10 pounds.
Water	20 gallons.

The sulphide of potash, commonly called liver of sulphur, is dissolved in warm water, and the solution thus made is used to slake the lime, which should be of good quality. After thorough mixing, the rest of the twenty gallons of water is added. This wash is more expensive than the lime, sulphur, and salt, as the sulphide of potash costs 22 cents a pound, but it is so much easier to make that for a small amount of spraying it may be preferable. Use a good quality of finishing lime.

Lime, Sulphur, and Salt Wash.—The experience of orchardists throughout the Eastern states indicates that the most effective remedy for the Pernicious Scale is the lime, sulphur, and salt wash. This is applied to the dormant trees in winter or early spring before the buds start, and is very efficient in destroying and checking the increase of the insects. It is a troublesome remedy to apply on a small scale, and is best attempted by commercial growers or by those who make a business of spraying. Its preparation necessitates large iron kettles or else a steam boiling outfit. After studying the practical experience of many Ohio orchardists, the Ohio Experiment Station recommends the following formula and directions:

Lump lime	25 pounds.
Salt	25 pounds.
Sulphur	25 pounds.
Water	75 gallons.

"Place the full amount of lime in the kettle or vat, or whatever the receptacle may be, and start it to slake with hot water, using enough to prevent the lime from being air slaked, but not enough to drown it. During the slaking process add the sulphur, all lumps having been first pulverized, and the salt; stir both of them in thoroughly, and add water gradually to reduce the mixture to a thin paste. If the mixture is not already boiling, bring it to this point and allow it to boil for one hour. If the wash is prepared in an iron kettle it will be necessary to add a bucket of water now and then to replace that lost in the boiling process, and to stir the mixture frequently to prevent burning and caking of materials upon the sides of the vessel. After one hour's boiling enough hot water should be added to make the required amount of mixture, or if cold water is used the proper proportion should be added and the wash again brought to the boiling point. The wash is now ready for use. It should then be emptied into the spraying barrel, being strained through common wire screening, and if possible applied while hot to the trees.

"To prepare the wash satisfactorily it is necessary to have a suitable outfit. In making plans for such, one should remember that the kind of plant, with reference to the use of kettle or steam to prepare the wash, location in regard to an abundant supply of water, and the number of handy contrivances for handling water and the wash, have much to do with the ease and cost with which this spray can be made and applied. If possible, use steam to prepare the wash. The outlay for a suitable plant need not be large, especially if the orchardist possesses mechanical ingenuity, for by using parts of old spraying apparatus and second-hand machinery, one may provide a very satisfactory outfit with comparatively little expense. The following brief descriptions will serve as a guide for the erection of an outfit adapted to individual circumstances.

"Two iron caldrons of sixty gallons capacity will make an outfit at a small outlay. It is not the most convenient arrangement but will answer very well the purpose of the owner of a small orchard, who would hardly find it profitable to erect a more elaborate plant. With such an outfit one can prepare in a day from three to four hundred gallons of wash, which will be sufficient to treat about two hundred and fifty trees of the size of seven-year old peach trees, employing one man to prepare

the wash, one to hold the nozzle, and another to operate the pump. The cost for caldrons, spray pump, and barrel will be from twenty to thirty dollars."

Calcothion.—This is a ready prepared lime, salt, and sulphur wash, made and sold by the Adler Color and Chemical Works, New York, N. Y. We used it on small trees where it was applied by brushes with excellent results. It is likely to be rather lumpy for spraying purposes.

These lime-sulphur combinations burn the skin, and so should be sprayed with gloves on the operator. "An application of vaseline to exposed parts will neutralize stray spatterings."

THE NURSERY INSPECTION LAW.

Soap Washes.—A solution of whale oil soap, or other insecticide soap, at the rate of two pounds to one gallon of water, is an effective winter wash for this pest.

At the session of the New Hampshire legislature for 1903, the following act, approved March 4, 1903, was passed to

Authorize the State Board of Agriculture to appoint a State Nursery Inspector and to provide for the protection of trees and shrubs from injurious insects and diseases.

Section 1. The State Board of Agriculture shall annually appoint some person qualified by scientific training and practical experience, to be state nursery inspector, and he shall be responsible to the board for the performance of his duties as prescribed in this act. The said inspector may appoint such number of deputies, not exceeding two, as he may deem necessary or expedient.

Sect. 2. It shall be the duty of the state nursery inspector, either personally or through his deputies, to inspect at least once each year all nurseries or places in the state where nursery stock is grown, sold, or offered for sale, and if no dangerous insect or fungous pests are found therein a certificate to that effect shall be given. If such pests are found therein the owner of the stock shall take such measures to suppress the same as the state nursery inspector shall prescribe, and no certificate shall be given until the said inspector has satisfied himself by subsequent inspections that all such pests have been suppressed.

Sect. 3. Any owners of nurseries or of places in the state

where nursery stock is grown, sold, or offered for sale, who do not hold an unexpired certificate of inspection after the first annual inspection made after the passage of this act, who shall sell or otherwise dispose of nursery stock in the state, shall be subject to a penalty of not less than twenty-five nor more than one hundred dollars for each offence.

Sect. 4. Any owners of nurseries or of places in the state where nursery stock is grown, sold, or offered for sale, who shall fumigate with hydrocyanic acid gas all stock which they sell, using at least two-tenths of a gram of potassic cyanide to every cubic foot of space contained in the box, house, or other place wherein this fumigation is performed, which place shall be gas tight, and who shall expose the said stock to the fumes of this gas of the strength aforesaid for at least forty minutes, or who snall treat the stock which they sell by some other method approved by the state nursery inspector, and who shall make affidavit before a justice of the peace that all stock sold by them has thus been fumigated or treated, and who shall attach a copy of such affidavit to each package, box, or car of stock sold, may be exempt from the provisions of sections two and three of this act.

Sect. 5. All nursery stock shipped into this state from any other state, country, or province shall bear on each box or package an unexpired certificate that the contents of said box or package have been inspected by a duly authorized inspecting officer, and that said contents appear to be free from all dangerous insects or diseases. In case nursery stock is brought within the state without such certificate the consignee shall return it to the consignor at the expense of the latter, or shall call the state nursery inspector to inspect the same; provided, however, that any package or box bearing a certificate of fumigation which meets the requirements specified in section four of this act may be accepted as though bearing a proper certificate of inspection.

Sect. 6. The state nursery inspector shall determine the season for inspecting nurseries and the forms of certificates to be given, but in no case shall he issue a certificate which shall continue in force after the first day of July next following the date of inspection. He or any of his deputies shall at all times have the right to enter any public or private grounds in the performance of any duty required by this act. The cost of said inspection shall not exceed $300 annually.

SECT. 7. All parties violating this act shall be prosecuted by the secretary of the State Board of Agriculture.

SECT. 8. This act shall take effect upon its passage.

This law was passed especially to prevent the introduction and spread of the San José scale and other insect pests. Before its passage New Hampshire was being made the dumping ground for infested nursery stock which could not lawfully be sold in other states. The law has already checked this trade, and has led to the stopping of sales of infested stock already within the state.

DO NOT BUY INFESTED TREES.

Any citizen who buys nursery trees should insist that they bear a certificate of inspection or fumigation, *preferably the latter*. For as already stated fumigated trees are less likely to carry the living scales. Two or three tiny specks on a young fruit tree, specks too small to be noticed by the eye, may mean the ruin of the orchards of a town. In all cases trees without a certificate should be refused and the facts reported to me in order that investigation may be made.

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